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*How to Control the Pollination
of Slash and Longleaf Pine*

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by François Mergen, Harry Rossoll and Kenneth B. Pomeroy



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U. S. Department of Agriculture - Forest Service

The tree improvement research leading to this publication was a cooperative undertaking of Yale University, the Florida Board of Forestry, and the U. S. Forest Service. Dr. François Mergen (formerly Geneticist at the Lake City Research Center) is Assistant Professor of Forest Genetics, Yale University, School of Forestry, John A. Hartford Program in Forest Biology at Valhalla, N. Y. Harry Rossoll, of Region 8, U. S. Forest Service, Atlanta, Georgia, made the illustrative drawings. K. B. Pomeroy is Officer in Charge of the Lake City Research Center.

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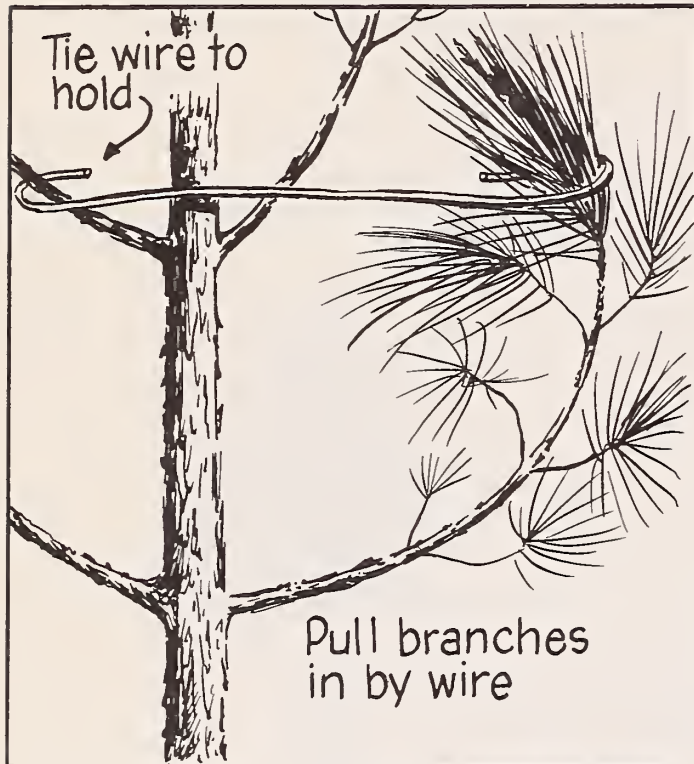
INTRODUCTION

In this outline, detailed instructions are given for controlled pollinations of slash and longleaf pine. The various steps are illustrated with true-to-life drawings. For more than a decade these techniques have been used with good results in the tree improvement program at Lake City, Florida.

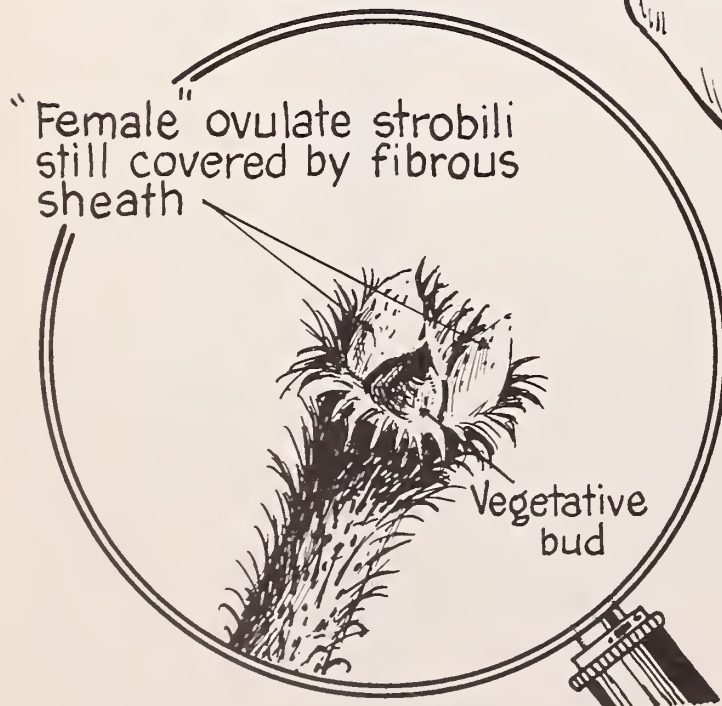
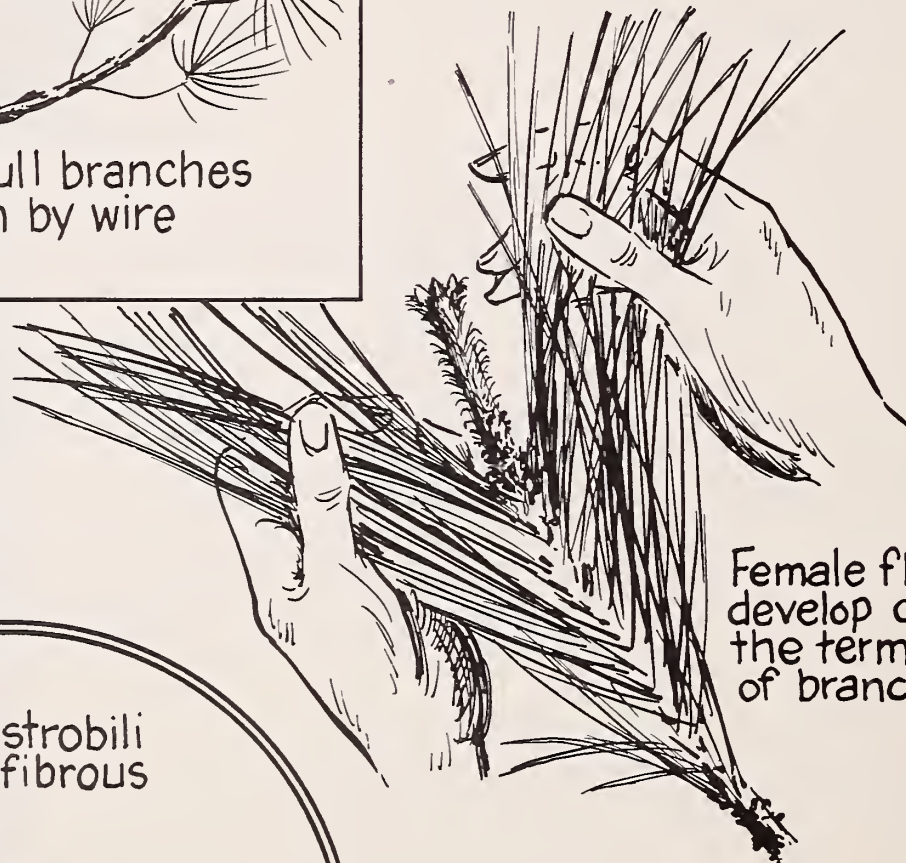
Foresters desiring a more thorough technical discussion are referred to USDA Circular No. 792, "Methods used to control pollination of pines in the Sierra Nevada of California," by W. C. Cummings, and F. I. Richter, published in 1948.



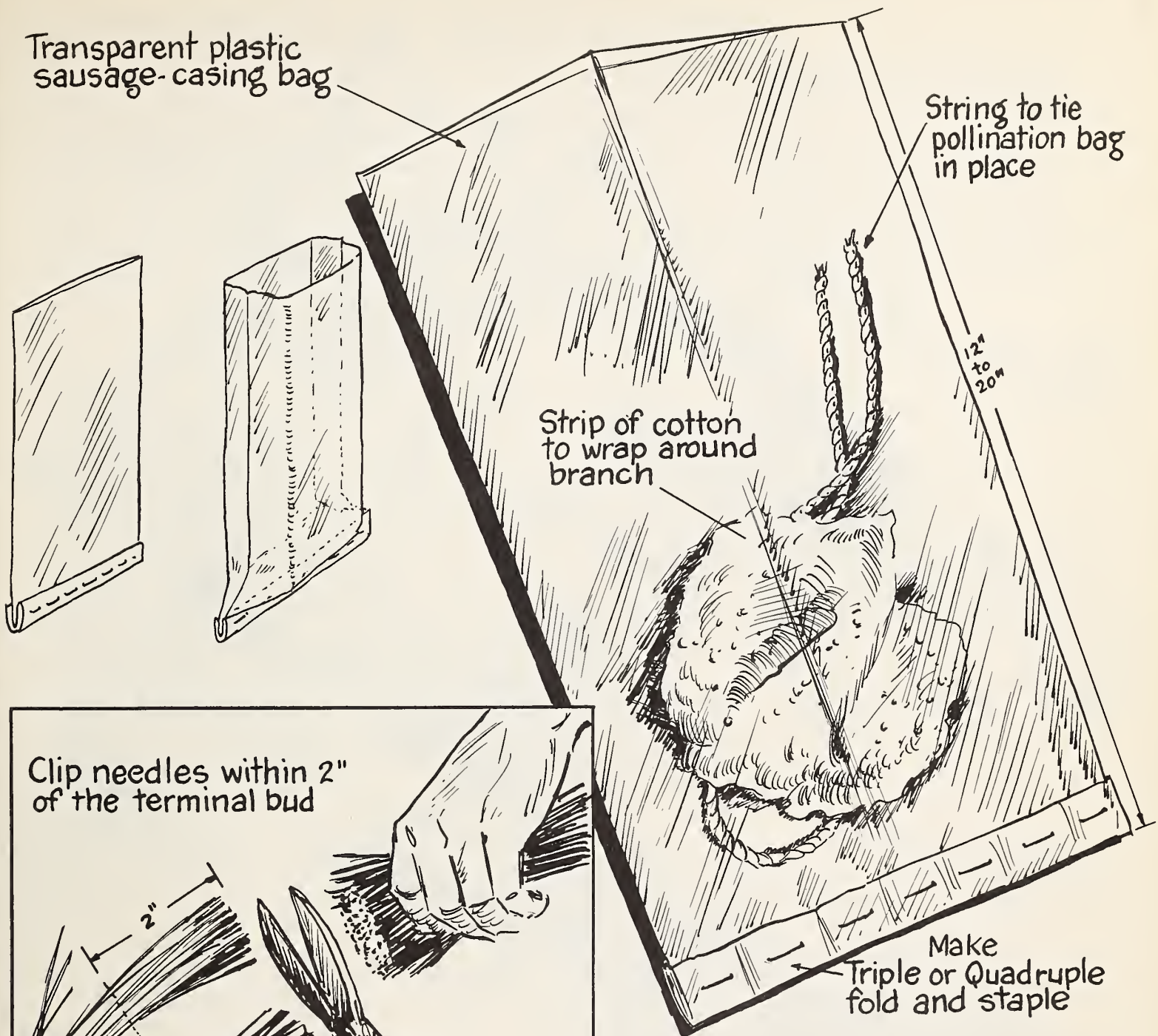
ISOLATION OF FEMALE FLOWERS



The female flowers or ovulate strobili are born right next to the terminal buds in the upper part of the crown. Slash pine flowers become visible early in January, while those of longleaf pines appear about 2 weeks later. A wire hook is an essential tool for pulling branch tips within "comfortable" working distance.

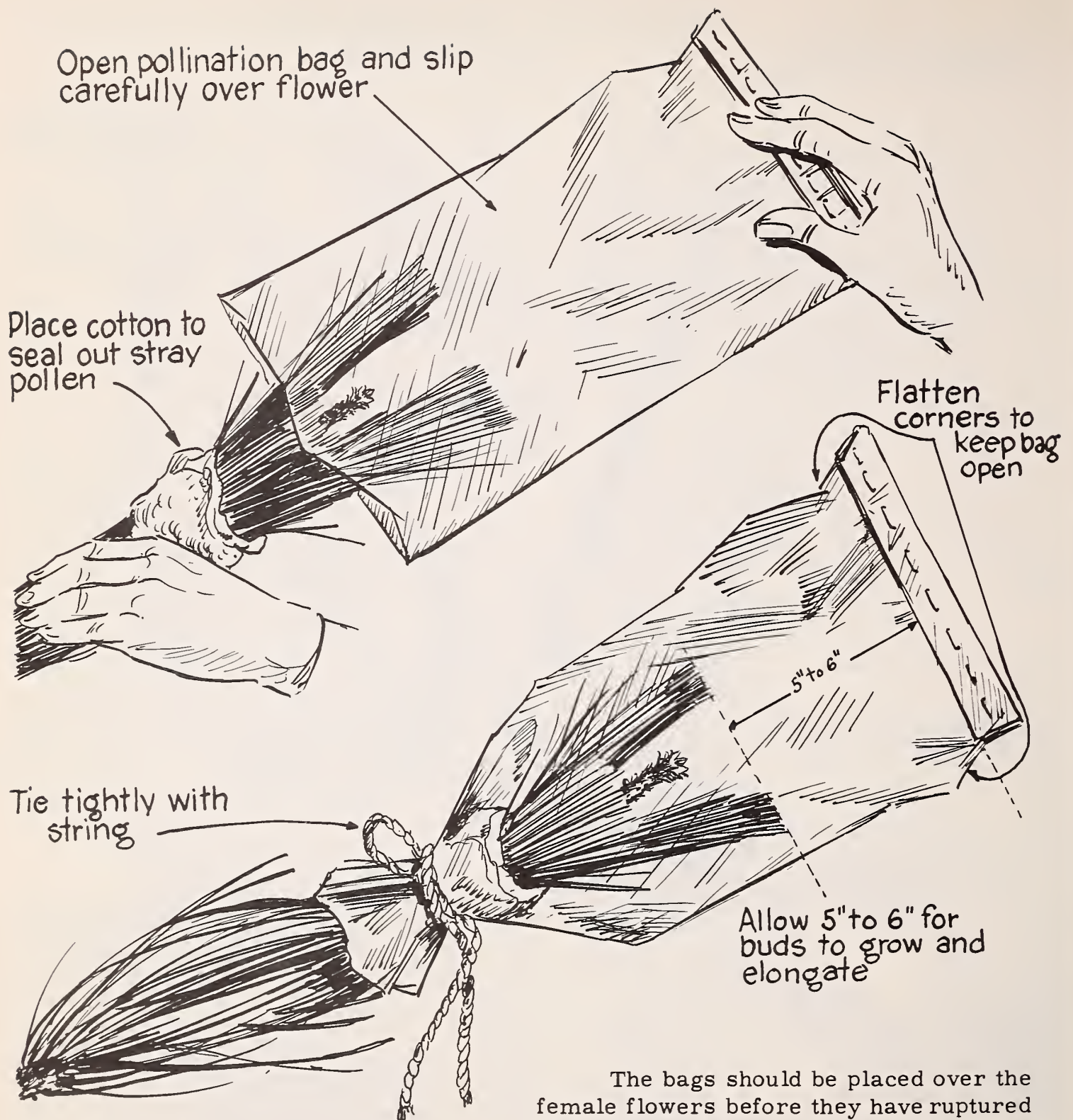


A white fibrous covering encloses the female flowers at the time they push through the thin scales of the "dormant" bud. The flowers appear either singly or in clusters of up to 20 per branch tip.



Plastic sausage casing is satisfactory for bagging slash and longleaf pine conelets. This type of bag is permeable to water and light, is strong, and inexpensive. The bags should be assembled on the ground; a strip of nonabsorbent cotton, and a piece of string are placed inside the bag to facilitate handling while in tree crowns.

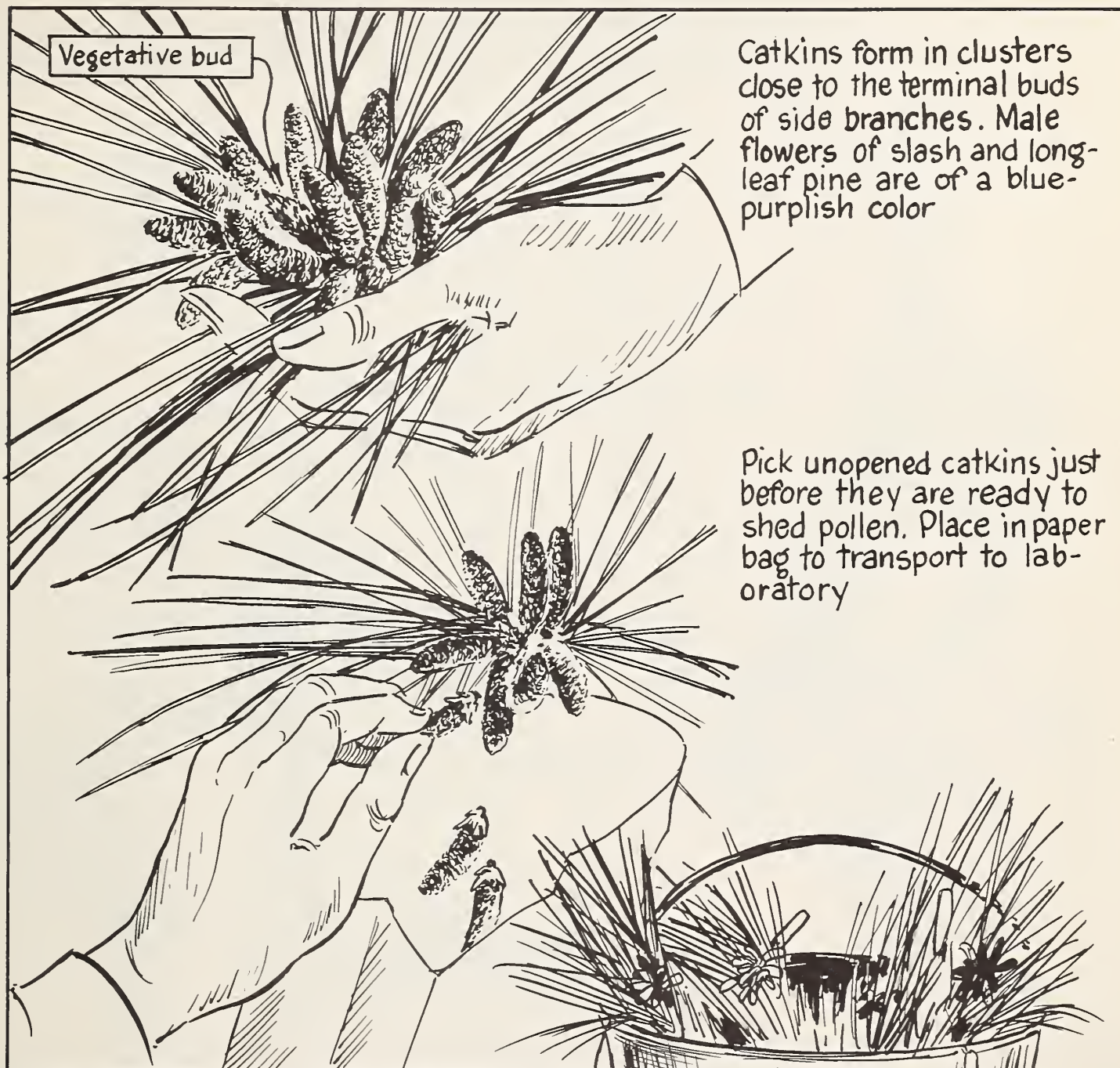
When clipping the needles, a "brush" of needles should be left on each side of the flowers to protect them in case the bag collapses.



The bags should be placed over the female flowers before they have ruptured the protective sheath and the scales of the conelet (pinkish-white in color) become visible. Before placing bag, check bud for male catkins. These should be twisted off unless selfing is desired. Place bag so that there is adequate space for the elongation of the vegetative bud during spring growth.

The bags should be tied firmly to the branches with a cotton string, or a combination paper-wire plant "twistem."

COLLECTION OF MALE CATKINS



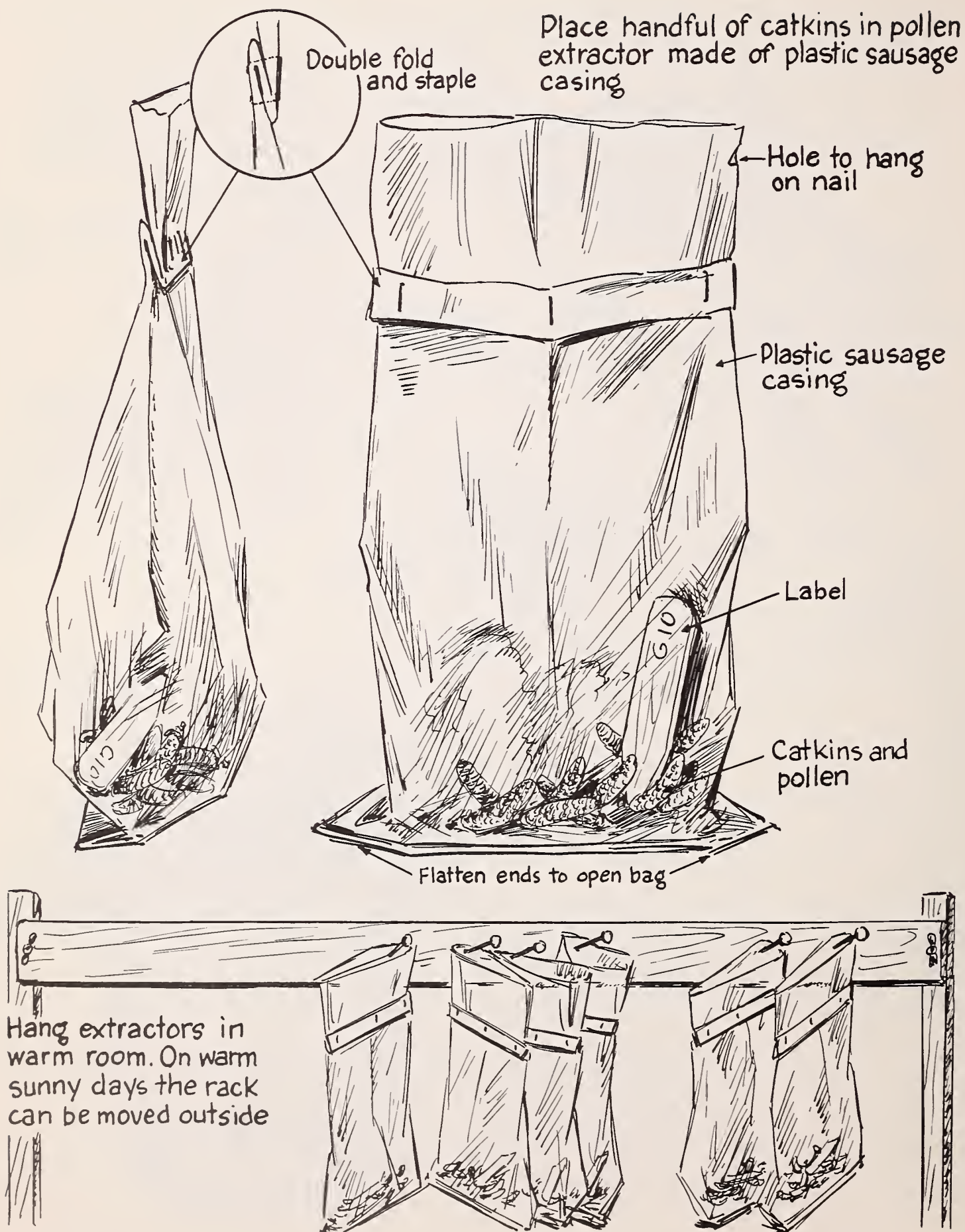
Catkins form in clusters close to the terminal buds of side branches. Male flowers of slash and long-leaf pine are of a blue-purplish color

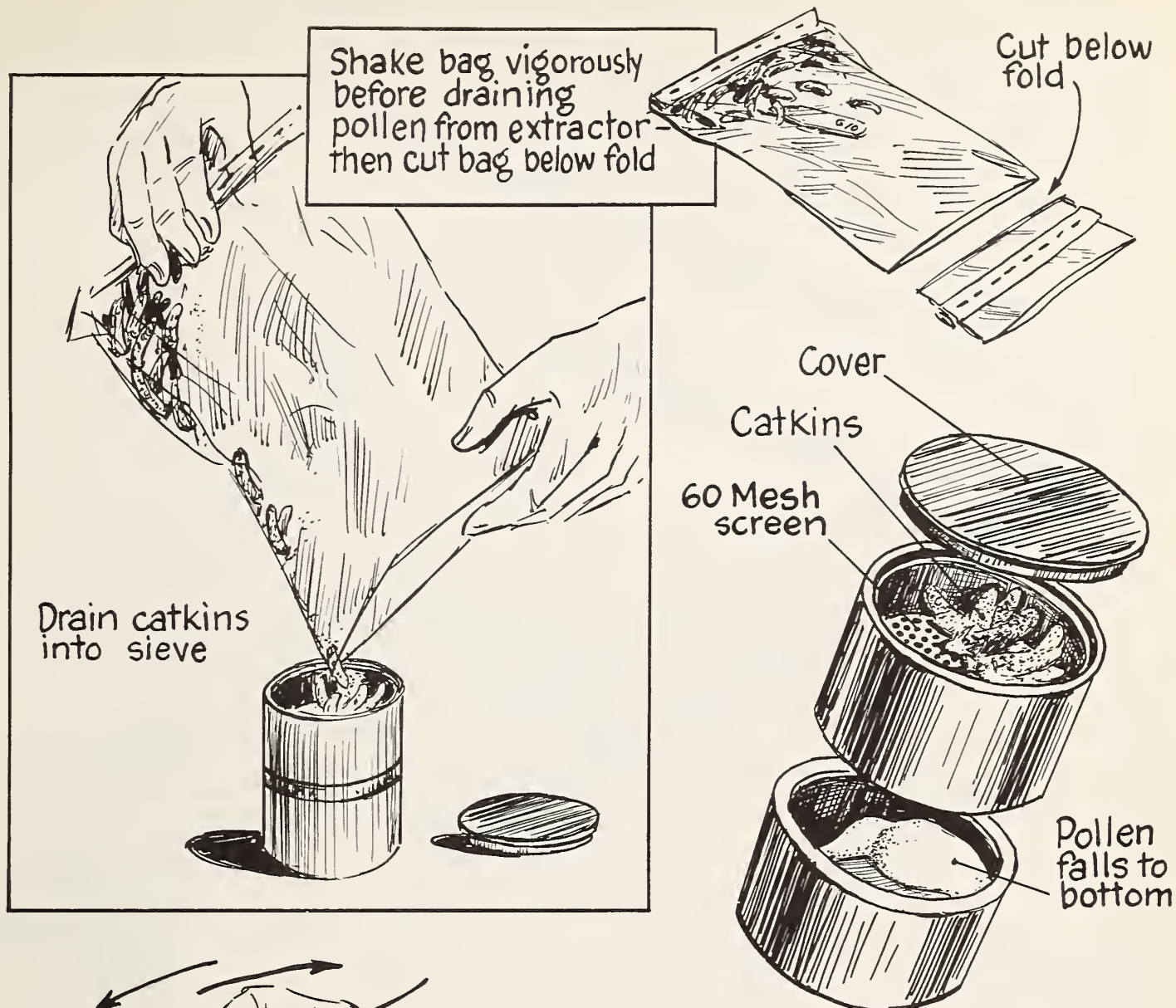
Pick unopened catkins just before they are ready to shed pollen. Place in paper bag to transport to laboratory

If catkins are collected before they are ripe, the ripening process can be speeded up by placing branches with catkins in pail of water in a warm room.

Catkins can be collected from a selected tree as soon as its ripest catkins begin to shed pollen. To facilitate pollen extraction do not collect catkins wet with rain or dew. Prevent molding by promptly transferring catkins to extractors.

EXTRACTION OF POLLEN

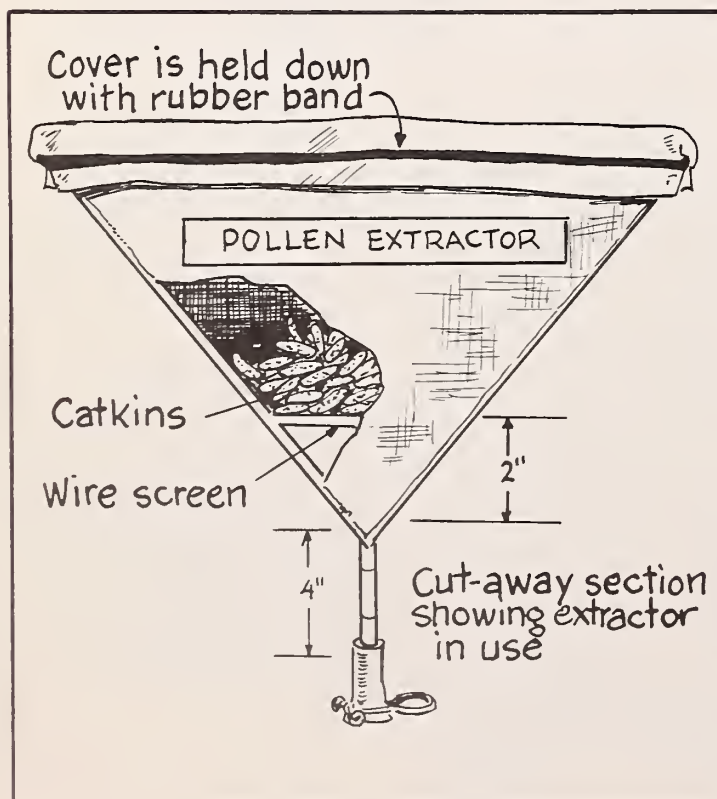
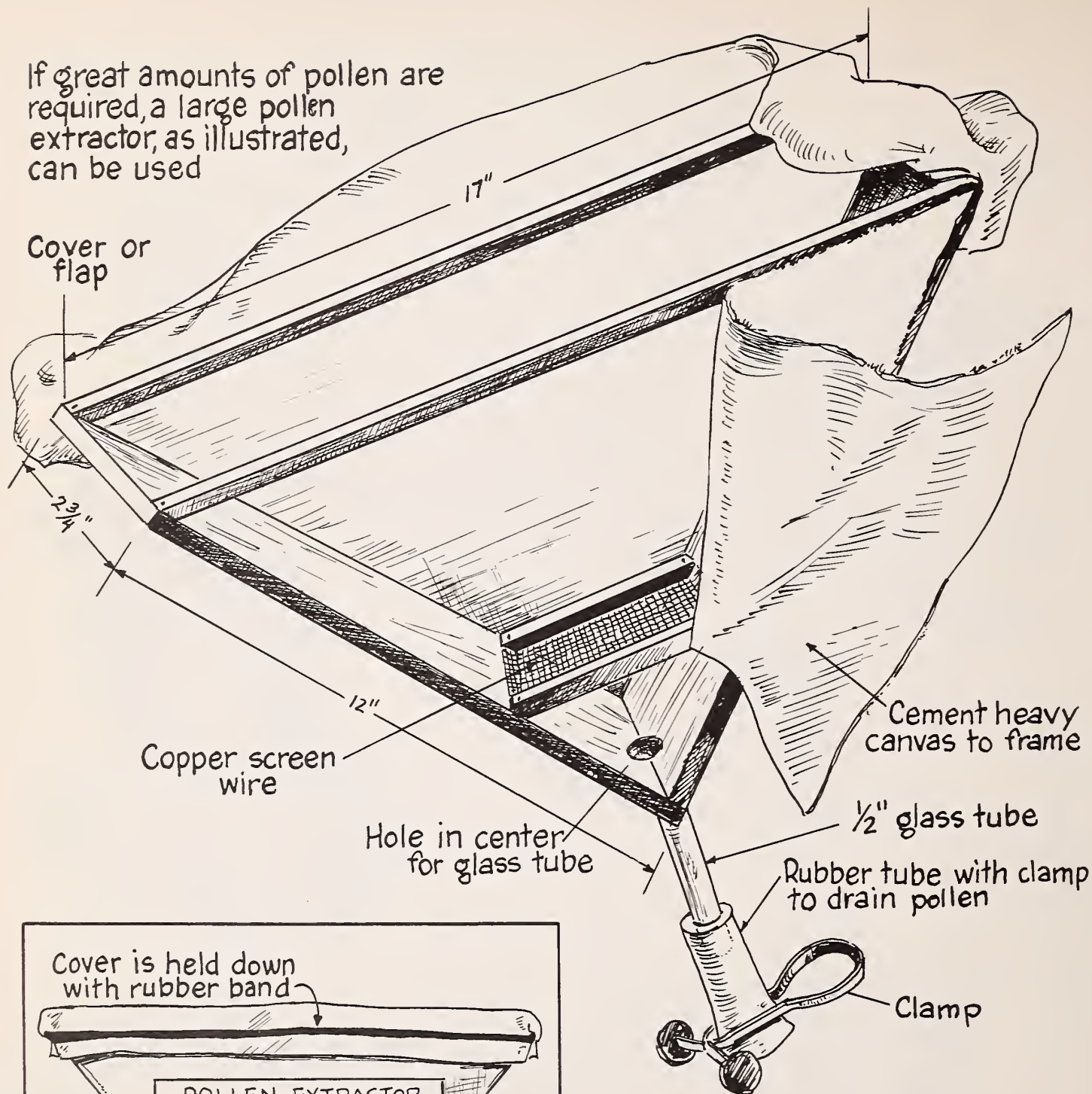




If only a small amount of pollen is desired, a hole can be punched in the wall of the bag and the pollen strained through it.

A regular soil sieve (60 mesh) is used when a large quantity of pollen is needed. To prevent contamination, the sieves should be sterilized after each use by either washing them in 95 per cent alcohol, or by placing them in a hot oven for several minutes. A combination of these two methods is very satisfactory.

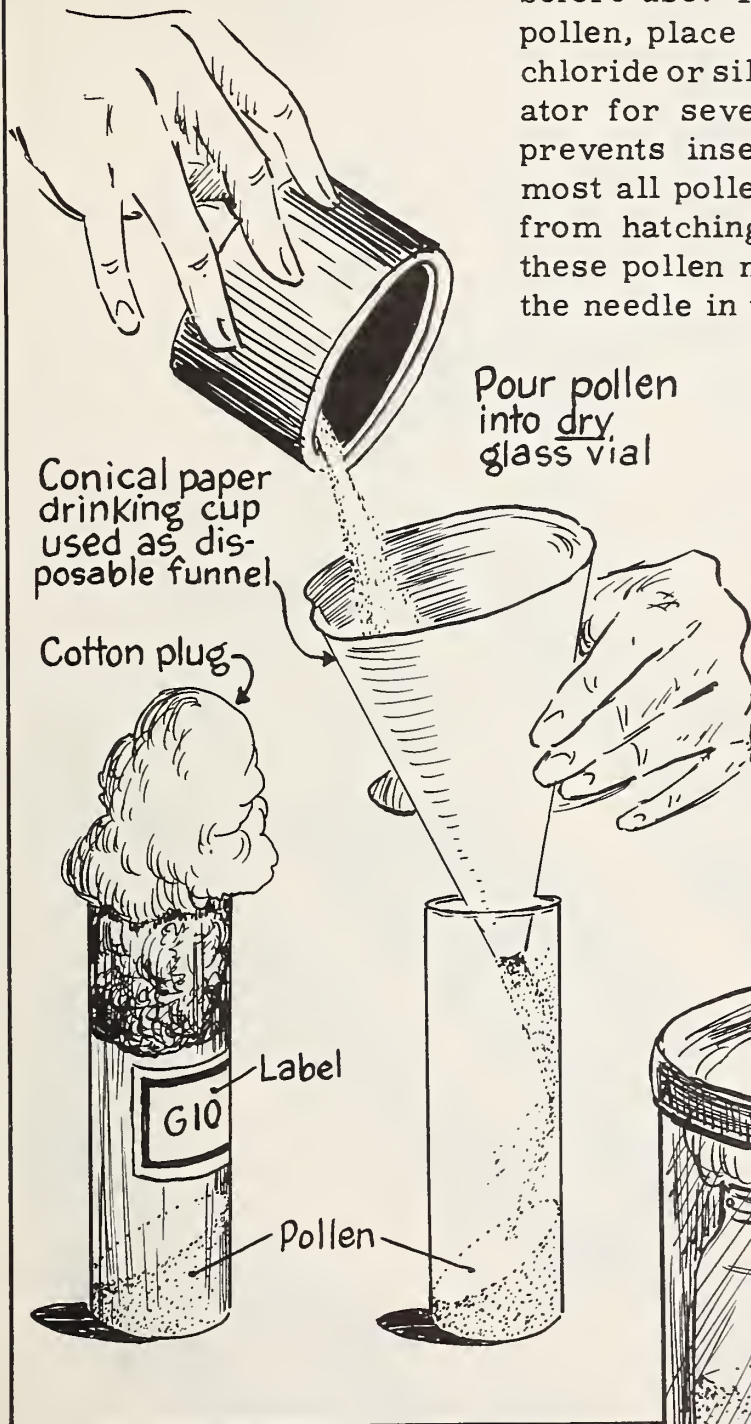
If great amounts of pollen are required, a large pollen extractor, as illustrated, can be used



If too large a quantity of catkins is placed in one extractor, poor air circulation will further the growth of mold. Mold will also develop if the catkins were too green or too moist when they were collected.

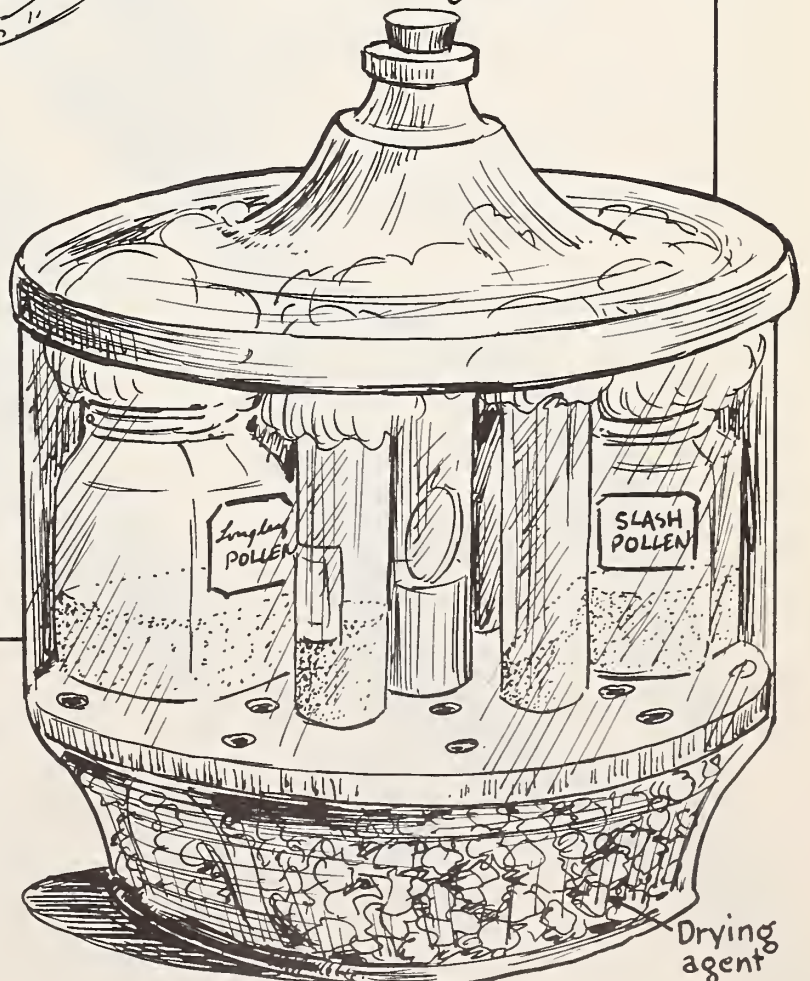
The extractor should be placed in a warm, dry room (80-90°F.) in which good air circulation is maintained.

The pollen should be handled in a draft-free room. All equipment should be sterilized before use. To prevent molding of extracted pollen, place cotton-stoppered vials in calcium chloride or silica gel desiccator in a refrigerator for several days. This treatment also prevents insect eggs, which are found in almost all pollen lots of slash and longleaf pine, from hatching. Besides injuring the pollen, these pollen maggots have a tendency to clog the needle in the pollinator.



After pollen has been stored at a low temperature, do not open vial until the glass of the container has reached room temperature. This prevents moisture from condensing on inside walls.

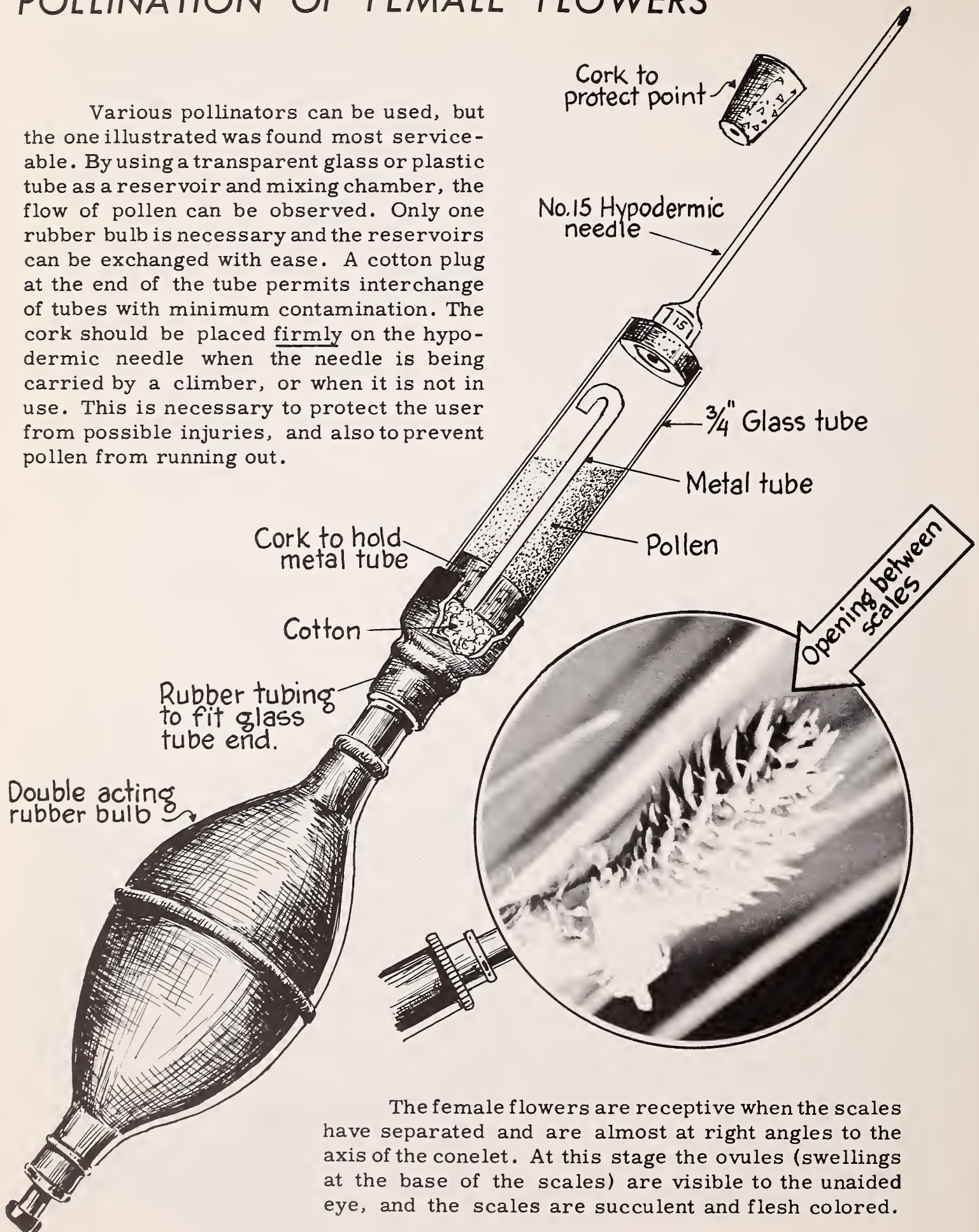
Store in desiccator kept in a refrigerator



Pollen may stay viable for a year when stored at 39° F. at a relative humidity of 30 percent. A relative humidity of approximately 30 percent is obtained by placing an excess of a sulfuric acid solution with a density of 1.45 in the well of a desiccator.

POLLINATION OF FEMALE FLOWERS

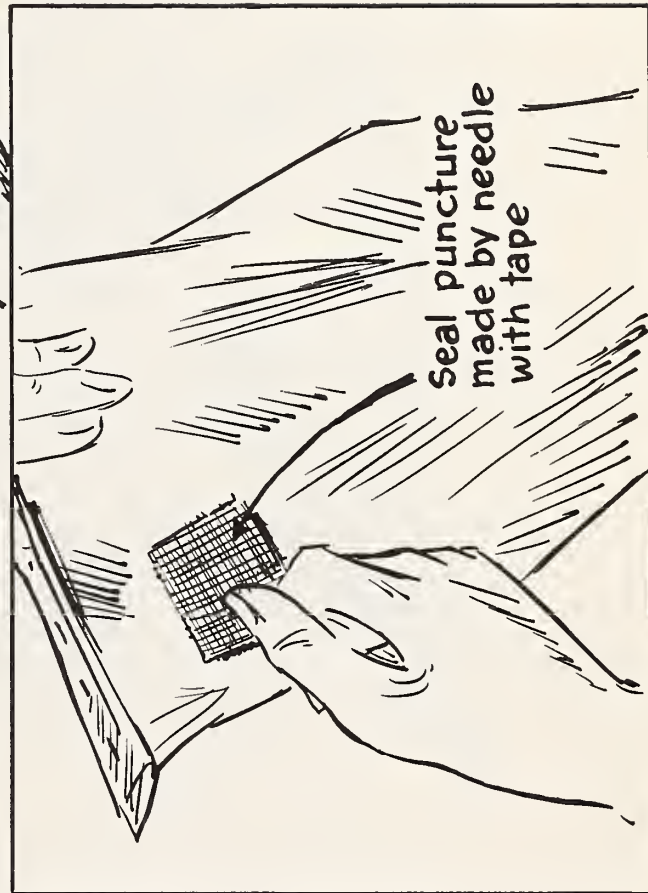
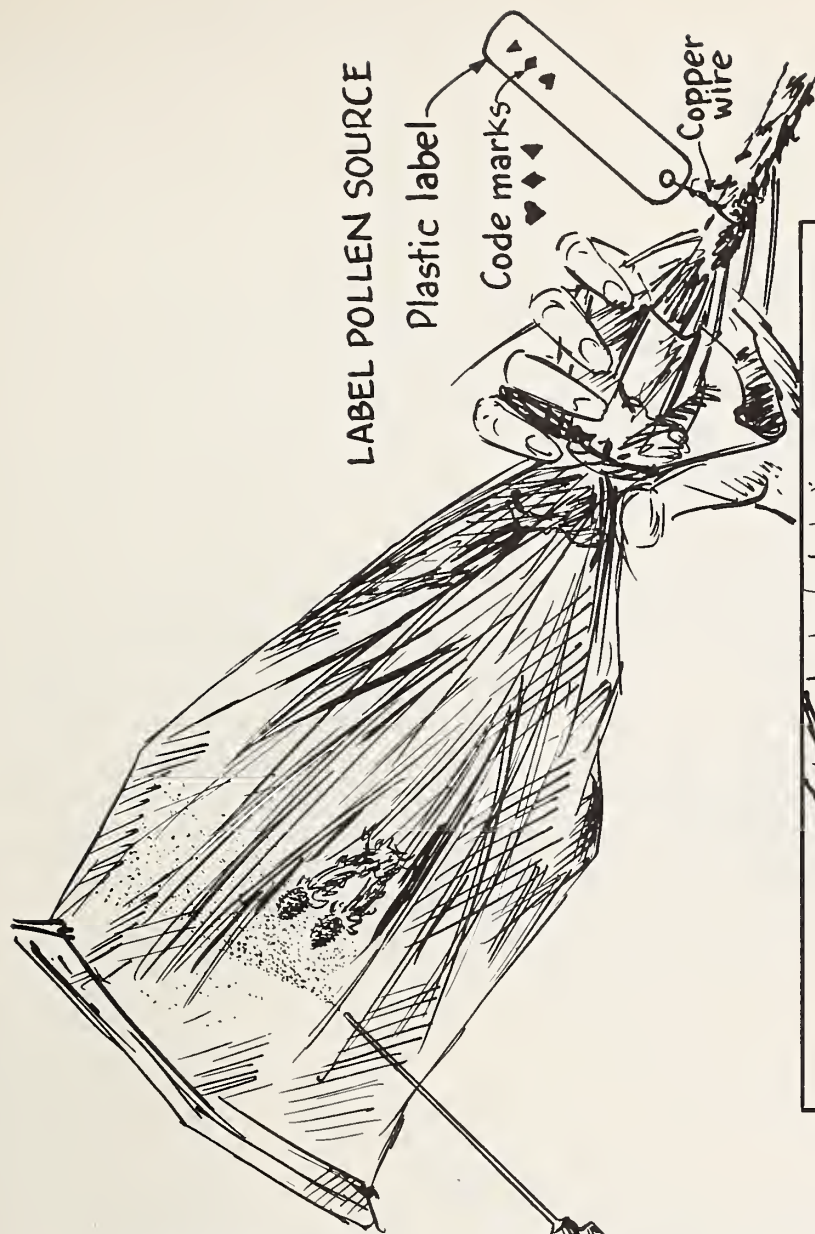
Various pollinators can be used, but the one illustrated was found most serviceable. By using a transparent glass or plastic tube as a reservoir and mixing chamber, the flow of pollen can be observed. Only one rubber bulb is necessary and the reservoirs can be exchanged with ease. A cotton plug at the end of the tube permits interchange of tubes with minimum contamination. The cork should be placed firmly on the hypodermic needle when the needle is being carried by a climber, or when it is not in use. This is necessary to protect the user from possible injuries, and also to prevent pollen from running out.



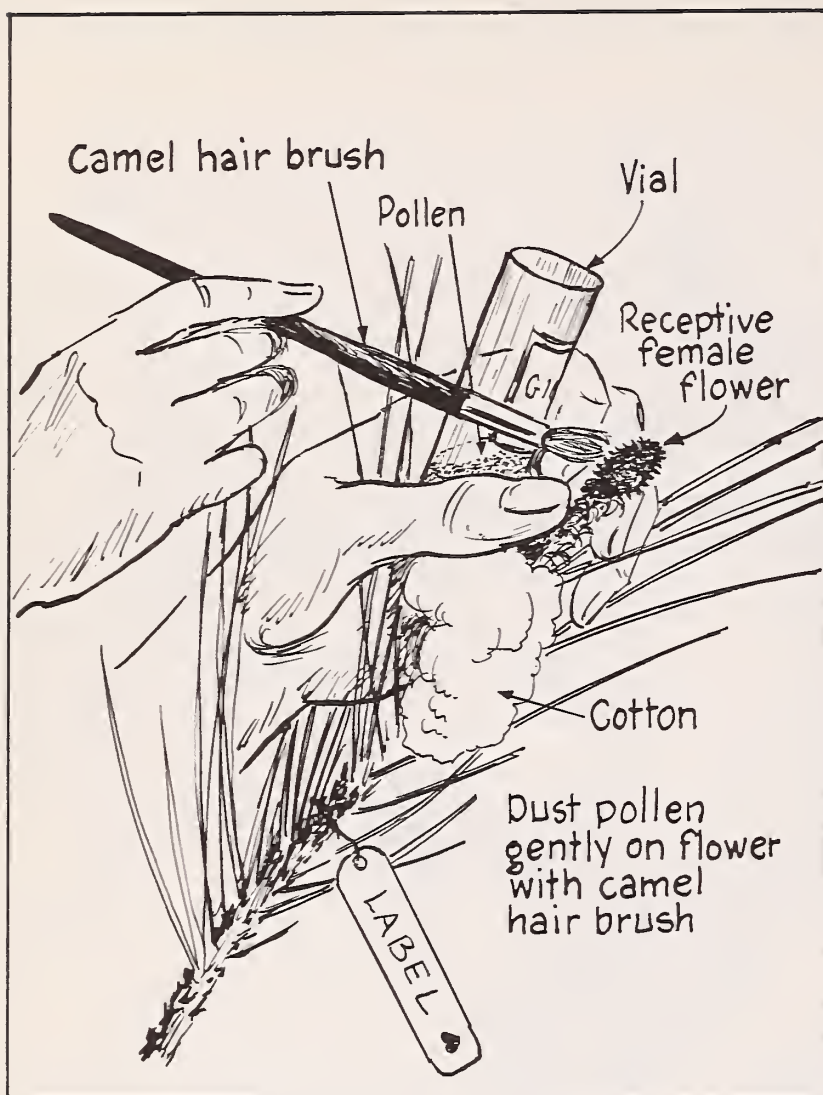
The female flowers are receptive when the scales have separated and are almost at right angles to the axis of the conelet. At this stage the ovules (swellings at the base of the scales) are visible to the unaided eye, and the scales are succulent and flesh colored.

To pollinate the flowers, the needle is pushed into the bag and pointed directly at the flowers. The best distribution of pollen is obtained if several small puffs are directed at the conelets. The scales should be covered adequately but not coated heavily with pollen. Too much pollen dries the liquid at openings to the egg cells, thus hindering pollen germination.

Permanent labels should be tied near each bag. A plastic label, code marked by a conductor's punch, is satisfactory.



Insert needle through wall of bag - blow cloud of pollen directly on to the receptive flowers. Shake bag to re-distribute pollen over the flowers



If only a small amount of pollen is available for a particular cross, it can be brushed on the receptive flower with a camel hair brush as illustrated. To minimize the danger of contamination by stray pollen, pollination should be done during the early morning hours when the relative humidity of the air is very high and when there is no wind movement. To pollinate the flower, the bag is removed temporarily and the pollen is dusted on the conelet. The bag is replaced right after pollination. Several hundred flowers can be pollinated with 1 cc. of pollen if this method is used. This technique results in a good seed set. It is recommended for making crosses in a grafted seed orchard where flower handling does not present a problem.

To remove the bag, one can use either of the two following methods: (1) Loosen string and slip bag carefully over flowers, or (2) with a pair of scissors or a razor blade cut the bag just above tie, and slip bag over flowers. When the second method is used, the remaining collar of cotton is plainly visible for some distance and helps to relocate the labels.

The bags should be removed as soon as the scales have closed, to minimize injury to the flowers.



PROTECTION OF CONES

Pine cones frequently are attacked by diseases, insects, and squirrels. Occasionally a destructive cone rust, Cronartium strobilinum infects very young cones, causing them to grow rapidly to an abnormal size and to assume a reddish color by mid-May. In Florida, where the disease is most prevalent, seed orchards can be protected by removing the alternate host of the disease, several species of oaks, from the vicinity.

It may be possible to control insect damage by spraying young cones with a 1-percent aqueous solution of benzene hexachloride (BHC). Such protective treatments are being tested further by the Southern Institute of Forest Genetics at Gulfport, Mississippi.

Squirrel activity in isolated trees or in seed orchards can be prevented by placing metal guards around the tree trunks. In dense forests such guards are impractical. Then it is necessary to enclose the cones in bags of wire mesh or heavy, porous cloth. If the protective bags are of tightly woven material, mold may attack the cones during periods of humid weather. So the weave must be loose enough to permit good aeration, yet tight enough to prevent loss of seeds or the entrance of cone moths.

RECORDS

Unless careful records are kept of the pollen sources which are used, one may end up with seed whose male parent is unknown or doubtful. A continuous record through the various steps will also help to determine at which stage the losses occurred. This will help a tree-breeder to improve his technique.

SAFETY

All work in the crowns of tall trees is dangerous. Take good care of ladders, ropes, and safety equipment; check position and buckles of safety belt before leaning out very far. Always push cork into needle of pollinator before placing pollinator into pocket or equipment pouch.

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GENETICS

Breeding
Report form

Tree No.

Location

Block

Row

Column

Bagged (Date & No.)

Bags removed

Pollinated (Date & No.)

Cones collected (Date & No.)

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